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Open File Report 89-39

INDUSTRIAL MINERAL PRODUCTION AND CONSUMPTION IN NEW BRUNSWICK

VOLUME 4

THE FUTURE OF INDUSTRIAL MINERALS: GENERAL TRENDS IN CONSUMPTION AND TRANSPORTATION

by

ADI Limited
Fredericton, New Brunswick

Canada-New Brunswick Mineral Development Agreement
Entente Canada-Nouveau-Brunswick L'Exploitation Minérale

Natural Resources and Energy New Brunswick
Ressources Naturelles et Énergie Nouveau-Brunswick
Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Price $2.95

This report has been prepared for:

Minerals and Energy Division
Department of Natural Resources and Energy
New Brunswick

Hon. Morris Green, Minister

1989

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This project was funded under the Canada-New Brunswick Mineral Development Agreement, a subsidiary agreement under the Economic and Regional Development Agreement.

Copies available by contacting:

Minerals and Energy Division
Department of Natural Resources
and Energy
P. O. Box 6000, Fredericton
New Brunswick E3B 5H1

1989

Report No.: Open File Report 89-39

Author: ADI Limited

Catalogue No.: ISSN 0712-4562

90-00794/

This report should be referenced in the following manner:

ADI LIMITED. 1989. Industrial mineral production and consumption in New Brunswick, Volume 4 - The future of industrial minerals: general trends in consumption and transportation. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division, Open File Report 89-39, 51 p.

PREFACE

From 1985-1989, the Province of New Brunswick, in conjunction with the Government of Canada, has initiated a number of mineral commodity studies through the Economic Development Program established under a Federal-Provincial Mineral Development Agreement. An important part of this agreement has involved studies designed in part to provide important marketing information on selected industrial minerals. These market-related projects have tended to concentrate on potential market growth areas primarily in North America, and particularly in areas where a New Brunswick producer could be competitive.

Whether it be building stone from Shediac, gypsum from Hillsborough or limestone from Saint John, industrial minerals have historically been important contributors to the economic growth and prosperity of New Brunswick. Today, industrial minerals are still important. Potash mining generates millions of dollars of salaries and business in the Sussex area, while the processing of phosphate rock with by-product sulphuric acid from a nearby lead smelter is a major industry in the Belledune-Bathurst region.

Preliminary figures for the value of industrial mineral production in New Brunswick was about $251 000 000 (Cdn) in 1988 compared to $197 000 000 in 1987. This represents an increase of twenty-two (22) percent. In 1988, industrial mineral production accounted for 31 percent of the total value of Provincial mineral production.

The manufacturing sector of the Province and surrounding areas consume substantial quantities of industrial minerals and their derived chemicals. Changing technology is making new demands on both the quality and quantities of industrial minerals consumed in the region. The requirement to document industrial mineral production in the Province as well as the consumption of these mineral commodities both, in the Province and adjacent areas, is becoming an increasingly important facet of responsible resource management.

Keenly aware of the importance of industrial minerals, the New Brunswick Department of Natural Resources and Energy has sponsored a review of industrial mineral supply and demand for New Brunswick (exclusive of granular and bedrock aggregate). The review was conducted under contract by ADI Limited and Three-D Geoconsultants Limited.

The purpose of the study is to provide as comprehensive and contemporary information as possible concerning the state of the industrial minerals industry in New Brunswick from both a producer's and consumer's point of view. Towards the achievement

of this goal, an assessment of the current supply/demand situation in the Province and adjacent reasonably accessible market areas was undertaken in an attempt to identify potential opportunities for market expansion and future development of indigenous industrial mineral resources. Another study objective is to indicate to various manufacturing industries where sources of various industrial mineral products are located in New Brunswick. Such an approach may be of some value in attracting new manufacturing industries to the Province. In addition, an attempt has been made to identify and document local market opportunties by showing producers where, in what quantities and under what circumstances industrial minerals and industrial mineral-based chemicals are being utilized within the Province and immediate surrounding areas.

Although this study focused primarily on the supply and demand of industrial minerals and industrial mineral-based chemicals produced and consumed in New Brunswick, the demand for similar products in market areas considered reasonably accessible to a local producer were also evaluated to some extent.

The results of the review were issued in the spring of 1989 and consist of a six volume report. Volume 1, 2 and 3 detail the history of specific industrial mineral production and consumption in New Brunswick and current demand within a market place easily accessible from the Province. Volume 4 provides demand projections for key industrial minerals, and describes the possible effects on future demand from environmental, technical, and other developments. Finally, Volumes 5 and 6 include a directory of New Brunswick's industrial mineral producers and consumers of industrial minerals within economic shipping distance of New Brunswick.

Component volumes of this extensive study are listed below:

Volume	Title	Open File Report
1.	Industrial Minerals Used Primarily in the Fertilizer Industry	89-36
2.	Industrial Minerals Used Primarily in the Construction Industry	89-37
3.	Industrial Minerals Used Primarily in the Chemical and Pulp and Paper Industries	89-38
4.	The Future of Industrial Minerals: General Trends in Consumption and Transportation	89-39
5.	Directory of New Brunswick Industrial Mineral Producers	89-40

Volume	Title	Open File Report
6.	Directory of Consumers of Industrial Minerals in Eastern Canada and the Northeastern United States	89-41

This volume addresses future trends in the regional consumption and transportation of industrial minerals.

VOLUME 4

THE FUTURE OF INDUSTRIAL MINERALS:

GENERAL TRENDS IN CONSUMPTION AND TRANSPORTATION

		Page
4.0	THE FUTURE OF INDUSTRIAL MINERALS	1
4.1	General Trends	1
4.2	Trends by Mineral	10
4.3	Projecting Industrial Minerals Markets	21
4.4	Transportation of Industrial Minerals	38
4.5	Conclusions	45
4.6	Bibliography	50

LIST OF TABLES

		Page
TABLE 1	CANADIAN GROSS DOMESTIC PRODUCT	23
TABLE 2	USA GROSS NATIONAL PRODUCT	24
TABLE 3	GROSS DOMESTIC PRODUCT OF CANADIAN REGIONS ...	27
TABLE 4	U.S. REGIONAL INCOME GROWTH	28
TABLE 5	CANADIAN GROSS DOMESTIC PRODUCT BY INDUSTRY ..	30
TABLE 6	AVERAGE CAPITAL UTILIZATION RATES OF CANADIAN MANUFACTURING INDUSTRIES	31
TABLE 7	GROSS NATIONAL PRODUCT BY INDUSTRY IN USA	32
TABLE 8	HIGH PRIORITY IMPORTANCE INDUSTRIAL MINERALS .	34
TABLE 9	HIGH AND MODERATE PRIORITY IMPORTANCE INDUSTRIAL MINERALS	39
TABLE 10	TRANSPORT MODE SYMBOLS	41
TABLE 11	TRANSPORT MODE USE MATRIX	43

LIST OF FIGURES

		Page
FIGURE 1	HISTORIC AND PROJECTED CANADIAN GROSS DOMESTIC PRODUCT	25
FIGURE 2	HISTORIC AND PROJECTED U.S.A. GROSS DOMESTIC PRODUCT	26

4.0 THE FUTURE OF INDUSTRIAL MINERALS

4.1 General Trends

4.1.1 Overview

Industrial mineral markets are presently experiencing profound changes. Some of the changes are positive for mineral producers, others are negative; however, all changes will greatly alter the ways that minerals are located, mined, processed and used.

A recent article (1) identified four major changes affecting all materials and material inputs. The first is substitution, which is now occurring at a rapid rate. The second is a new design philosophy which requires that materials be designed for applications rather than tailoring the application to the material. The third change is the rise of the global economy and the increased availability of low-cost raw materials from the Third World. The final change is market saturation especially in the developed countries. This is leading to market diversification as firms try to maintain acceptable rates of growth and profitability. In a nutshell, these changes have led from a situation of old markets for old materials to new (larger, broader) markets for new materials.

Substitution is a process as old as man. Tools are substitutes for hands, as is stone for bone and metal for stone. Each of those substitutions took thousands of years. Recently, however, the pace of substitution has increased greatly. Consider soft drink containers: in the last 25 years steel cans replaced glass bottles, aluminum cans replaced steel cans and now plastic

bottles are replacing aluminum cans. In some cases the substitution has even affected the concept of the product: consider the digital watch which is free of springs, gears, and even a clock face.

The substitution trend means that certainty is reduced and change is more rapid for mineral producers as buyers change their materials and material sources.

The new design philosophy has been aided by recent developments in materials science and engineering which have created large, new categories of composite materials, alloys, coated materials and other combinations. Now there are materials which are strong and light, hard but not brittle. With these developments engineers can produce bulletproof vests of woven plastic, powerful portable computers, tents which cover several acres, superconductors and other products which were only ideas a few years ago. The key here is that the material suits the design--the design is no longer compromised to suit the material.

What this philosophy means for industrial minerals and all other raw materials is that they will be used in smaller quantities for many more uses. There will be many buyers but quantities will be small. There will be many more specifications to meet.

In the 1970s many Third World countries committed themselves to programmes of industrial development, spending hundreds of millions of dollars on heavy industry, energy, light manufacturing, and raw materials exploitation. During the 1980s most of these countries have become deeply indebted and forced to produce and sell their products, raw and manufactured, at low rates to pay for accumulated debt. Low wages, year-round working conditions, no or weak safety and environmental regulations all result in these countries being the world's low-cost producers.

With improved communications and low-cost transportation industrial minerals and other Third World products can reach world markets quickly and cheaply.

The effects of Third World production and the global economy upon Canadian mineral producers has been drastic and mostly negative as minerals from foreign sources compete with higher-priced Canadian minerals.

Saturated or declining market conditions have already affected several mineral commodities. Silica consumption, for example, is declining due to shrinking glass markets, declining sand blast markets, static refractory markets and slow growth in the use of silicon metal. Glass recycling, substitution for glass, sandblast sand and silica refractories, and health concerns regarding silicosis are other factors reducing silica consumption. (2) As populations stabilize in Western Europe, North America, Australia, and Japan, the rate of growth for many products should decline or even reverse.

Saturated markets mean that industrial mineral producers must find new customers and new uses to sustain market growth and must work hard to maintain current levels of consumption.

Taken together, the four factors of substitution, the new design philosophy, the global economy, and market saturation point to a tougher business climate for mineral producers than they have faced in the past. This could result in producers becoming more dependent upon consumers unless the producers lead the consumers through the development of new and better uses for their minerals. The aluminum companies, for example, have consistently developed new products (e.g., compact discs) and improved old products (e.g., lighter, stronger alloys for airplanes) thus expanding the demand for aluminum. Silica producers, on the other hand, have become victims of their customers' demise.

In response to these major, world-wide trends, mineral producers have adopted a wide range of actions as detailed below.

4.1.2 Changes in Industry Organization

Historically, businesses have faced increased competition by acquisition and merger, thereby reducing the number of competitors and increasing the strength of each player. These activities are called rationalization.

In the gypsum industry, rationalization has already occurred with a few large firms (National Gypsum, United States Gypsum, Georgia-Pacific, Domtar) controlling about 80 percent of the North American market. Similar situations exist for: cement industry (four firms dominate Canadian cement production: Lafarge Canada Inc., St. Lawrence Cement, CBR, and St. Mary's Cement).

- lime production (most regions have only a few large lime plants such as Havelock Lime in the Atlantic Provinces);

- phosphate rock mining (nineteen firms produce all of North America's phosphate rock);

- potash production (eight firms control all of Canada's potash production, in turn Canadian producers account for over 80 percent of North American production);

- salt production (eight firms account for all of Canada's production with three firms accounting for 75 percent (the Canadian Salt Company Limited, Domtar Inc., and Dow Chemical); nine American companies produced 84 percent of United States salt);

- sulfur extraction (seven firms in Canada account for almost 80 percent of production).

Further rationalization continues.*

For silica and clay, consolidation has not progressed as far but both minerals are in overcapacity and rationalization is progressing rapidly. For example, United States Borax and Chemical Corp. (3) recently purchased both Ottawa Silica and Pennsylvania Glass Sand Corp. Interestingly, L.E. Shaw Limited has lead the trend and is the sole major producer of clay products in the Atlantic Provinces.

4.1.3 Mineral Exploration, Mining and Supply

There are conflicting trends in the mineral supply industry. In the short-term, these trends should lead to oversupply and reduce mineral prices; in the long-term, supplies should become tight and prices rise.

At present, there is a world-wide surplus in many industrial minerals. The reason for the surplus is a high level of production in both Third-World and industrial countries as these countries compete for export earnings. Low-cost ocean transport allows producers to supply minerals to any port in the world more cheaply than land-based operations only a few hundred kilometres from the same port. Cement imports, for example, have drastically affected domestic American production. (4)

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*Some recent headlines from "Rock Products" magazine: "Holderbank Consolidates North American Operations" (March 1988), "Buyouts in the Aggregate Industry" (March 1988), (May 1987), "Vulcan Plans to Acquire Whites Mines" (October 1987), "Ideal Basic Acquires Houston Cement Companies" (May 1987).

Recycling and substitution also keep prices low by reducing demand for primary material. Glass-grade silica is a good example, for not only are glass producers faced with substitution by plastics, aluminum, paper and steel, but glass recycling reduces the quantity of primary silica required for each glass batch. (5)

Improved exploration techniques are discovering resources easier, more quickly, and at less cost than before. As a result, more producers are starting operations or will start operations once prices are acceptable - a situation which will keep prices and profit margins low.

By-products too are affecting mineral markets. The best example is by-product gypsum from flue gas desulphurization (calcium carbonate plus sulphur dioxide yield calcium sulphate) and fertilizer production (phosphate rock treated with sulphuric acid yields phosphogypsum). To date, by-product gypsum has been considered inferior to primary material but gypsum prices and environmental pressures are influencing this trend. (6) Flue gas desulphurization also can produce by-product sulphuric acid.

In the long-term, however, many minerals will become scarcer and more expensive as high-quality, easily accessible, and easily developed resources are depleted. Very likely phosphate rock will be among the first minerals to be affected by this trend. Almost all of North America's phosphate rock comes from Florida and resources there are limited. It is estimated that even the United States will require imported phosphate rock by the year 2000. (7)

As high quality mineral sources become depleted lower quality sources will have to be used. Ore beneficiation will become more common and more elaborate, subsequently raising production costs and selling prices.

4.1.4 Mineral Processing

Faced with mature or slow-growing markets and increased competition, mineral producers are following two predictable production strategies:

1) reducing production costs, and
2) increasing the value added to their product.

The key to cost reduction is reducing the costs of production inputs: raw material, labour, energy, packaging and transportation. Raw material costs are reduced through economies of scale, thus production facilities have tended to become larger. This has been part of the rationalization process discussed earlier. Better equipment reduces wastage of material. In some cases substitutes are used as inputs such as potato starch for potash processing. (4)

Labour costs are reduced through increased productivity - usually using automation. Automated controls can reduce the number of workers required to monitor, control, and operate kilns, screens, washing plants and other equipment. In addition, properly set controls can improve product quality.

While energy costs have fallen in the middle 1980s, most producers are still striving to reduce energy consumption as most minerals require very high energy inputs for calcining (lime, gypsum, kaolin, cement, diatomite, dolomite), firing (bricks), washing and screening (silica), or dissociation (salt). The efficiency of processing plants has increased steadily in recent years as has energy conservation through insulation and recycling. Where cost-effective, processors have converted to locally available fuels such as natural gas, coal, wood, electricity and even waste materials and away from oil.

Packaging and transportation costs have been reduced through the use of bulk shipping. Deregulation and a depressed market in ocean shipping have provided producers with more choice in transportation modes. As a result, more minerals are now shipped in bulk by ship or unit train to either distribution points or final customers.

In contrast to the cost trends favouring the concentration of mining and production, market trends favour specialized production. Customers are requiring more stringent mineral quality and are willing to pay more for better quality. Examples include higher purity, more stringent size control, calcined minerals, coated minerals, and bleached minerals. A review of prices in the Chemical Marketing Reporter illustrates how specialty minerals and specially-treated minerals command a premium: ground, white barite is worth 45 percent more than coarse, off-colour barite; dry-ground micronized silica at 99.9 percent purity and 99 percent finer than 10 microns is worth 225 percent more than dry-ground silica at 98 percent purity at 200 mesh. (8) Value-added processing is the key to profitable mineral production.

4.1.5 Consumption

In general, consumption of minerals has tended to become more dispersed with the number of uses increasing and the volume of mineral consumed by any one use decreasing.

Driving this trend is the desire of both producers and users to reduce dependence upon one market/source. As well, research and development is creating whole categories of specialized materials which means that an "all-purpose" mineral is becoming rare. For example, barite is still an important component of drilling muds and fluids but other minerals and compounds are supplementing it in the mud mixtures.

Under these conditions producers can either take an active role in developing new mineral uses or a passive role, waiting for independent researchers to discover the potential of their mineral. The Portland Cement Association, the lime producers, and the other major groups of mineral producers have been active in developing new uses for their minerals. Examples include: sulphur asphalt, neutralization of acid lakes with crushed limestone, use of dolomite as a source of magnesium for soil.

4.1.6 Other Trends: Environmental and Public Health

The environment and public health have become major public issues and industrial mineral production and consumption have been and will continue to be affected by them.

Mining disturbs the environment by creating large areas of bare rock through site development, quarries, spoil piles, and run-off. In turn groundwater pollution, acid runoff, erosion, and the release of heavy metals can affect the environment over considerable distances and for many years. The adverse effects of mining can be reduced through careful planning, operation, and site restoration but, even so, permanent change occurs.

For some citizens no change is acceptable and although this group is small it is very vocal. In other instances poor planning, careless operation and/or no site restoration has angered a large segment of the public. As a result, mining operations are often unpopular and strenuously opposed. Overcoming the opposition is expensive and time-consuming.

A more serious objection to mining, processing and use arises when a mineral or its by-products is found to be harmful to the environment or human health. A classic example is asbestos which went from being a widely used and very useful mineral to

one which is used only under very restrictive conditions. Recently silica has come under scrutiny because of concerns regarding silicosis - a lung disease. Most industrial minerals pose little risk (barite) or an accepted risk (quicklime, for example) but biological and medical research is regularly uncovering new hazards.

The trend is not all adverse, however. Flue gas desulphurization could become a valuable source of gypsum and sulphuric acid. Water and wastewater treatment processes are major users of chlorine, lime, limestone, silica, sulphuric acid, and sodium bicarbonate.

4.2 Trends by Mineral

The previous discussion presents the overall trends affecting industrial minerals. Presented below are important trends affecting individual minerals. Each mineral summary describes how mineral production and consumption will be affected by the overall and smaller trends.

4.2.1 Cement

Cement is one of the industrial minerals most affected by the development of a global economy. The raw materials required for cement production are quite common and therefore can be produced in most regions of most countries. However, there is a large and growing international trade in cement, driven by price and lead by low-cost producers. This is the major trend affecting the cement industry.

Cement imports have become a large part of the United States supply (19 percent in 1987) and have grown rapidly through the 1980s (from 4.0 M tonnes in 1983 to 17.0 M tonnes in 1987).

This has caused severe dislocation with some parts of the domestic American industry affected by plant closures and company buyouts - often to foreign companies. (9, 10)

The Canadian industry has not been as badly disrupted by the apparent global cement market, although Canadian production is now 83 percent owned by foreign interests.

In the future, the pace of change in the cement industry will likely slow down as the reorganization reaches maturity. However, the resultant industry will be much different than it was prior to the 1980s.

Other, positive trends affecting the cement industry are:

- research into the recovery and treatment of cement dust from kilns to permit recycling. (11)

- new concrete additives which will allow placement at temperatures as low as -7°C (11) plus other additives to improve concrete properties.

- use of waste chemicals as fuel. (12)

- more efficient energy use through better kiln design, better fuel feed and improved kiln insulation.

4.2.2 Clay

The clay products industry is one of the most fragmented of the industrial minerals industries with dozens of small to medium-size clay producers and users across North America. A major trend in the next few years is the rationalization of the clay

products industry into a number of large firms and plants. These firms produce standard products at lower cost, better profit, and greater efficiency. Smaller firms and plants will survive by specializing.

With rationalization should come improved product standards, increased research and development and a more organized approach to marketing. These improvements will allow bricks to compete more successfully with lumber, concrete, steel, glass, gypsum products.

Specific production improvements include:

- reduction of energy consumption in clay firing (13).
- enhanced clay processing and grading (better clay, new grades) (14).
- more efficient mining (14).
- more successful exploration and location of clay deposits (14).
- increasing use of coal-fired rotary kilns (14).

Market changes include:

- a decline in clay refractories.
- good potential for expanded aggregate for road surfaces.
- a slow growth in structural clay products.

4.2.3 Diatomite

The growth prospects for diatomite are good because of its unique properties and uses. Diatomite is a non-reactive silica mineral with a unique cellular structure allowing it to be used as a filter aid as a sound insulation, and as a filler. All these markets offer good growth prospects.

4.2.4 Dimension Stone

Through the 1980s there has been renewed interest in building stone by architects, landscape designers and interior designers. The increase in interest has been caused by a change in architectural style and also new technology which has provided more stone shapes at lower cost.

It is likely that demand for building stone will remain strong in the short and medium term but that the high growth rates in demand of the 1980s will be reduced.

4.2.5 Dolomite

The long-term decline of the open hearth steel furnace has reduced the market for dolomite. Now the only large markets left are aggregates, refractory products, and agriculture.

Aggregate demand should remain strong for dolomite but the demand will fluctuate with construction activity. This is a relatively low value use.

Refractory demand could grow but will remain a small volume, high value market.

In agriculture dolomite raises pH while providing a source of magnesium, an important micronutrient. This is another low value use but demand should grow.

4.2.6 Graphite

Graphite is a "mineral of the future" and this represents great opportunities for graphite producers. Graphite's promise is due to its use in many advanced composite materials such as plastics, plastic composites, woven materials, metal-matrix composites and coated materials. (15) At present these materials represent only a small portion of demand.

4.2.7 Gypsum

At present, gypsum has one main use: as a building product, primarily in prefabricated building panels (wallboard, plasterboard). There appears to be only limited research directed at discovering new uses for gypsum and few substitutes for gypsum wallboard so the consumption pattern should remain unchanged for some time to come.

There are two trends which could affect gypsum production, however. First, there is potential for large, new sources of gypsum as a by-product from flue-gas desulphurization and fertilizer production. In recent years flue-gas gypsum has been used as a feed for wallboard in Europe, Japan, and the United States (6, 16). Fertilizer gypsum (phosphogypsum) has not been used due mainly to the low-level radiation of this product. (6) For all by-product gypsum sources, material purity has been a problem but, as conventional sources become depleted, prices rise, and by-product disposal grows as a problem, more and more gypsum will come from these sources.

The second trend is the growing use of gypsum mixtures in wallboard. Pure gypsum has now been replaced by mixtures of gypsum and organic fibers such as wood chips and paper. The new wallboards have less weight but equal strength. (6)

Energy conservation in gypsum production is receiving considerable attention. Energy is a major cost of plaster and wallboard production due to the calcining process.

4.2.8 Kaolin

The outlook for kaolin is excellent because of its many desirable properties (including environmental compatibility) and relatively low price. In addition, there is an active research and development programme with the objective of finding new uses for kaolin; this research is funded by a well-organized industry which has a small number of large firms.

4.2.9 Lime

The major trend affecting lime markets in the short and long-term is the growing use of lime in environmental protection. Lime and limestone have established markets in municipal and industrial wastewater treatment but large, new markets are evolving in desulphurization of exhaust gases and neutralization of acidified lakes and streams.

Smelting of sulfide ores and burning of fossil and organic fuels creates sulphur dioxide gas as a by-product (see "Sulphur" later in this chapter). In the past this gas was released to the atmosphere but now it has been proven to be a severe environmental pollutant. The most common methods of controlling sulphur dioxide emissions use lime (calcined or hydrated) or limestone and represent a very large market opportunity. The by-product of the lime-sulphur dioxide reaction is gypsum (see "Gypsum" earlier in this chapter).

As a calcined mineral, lime has a large energy component in its production costs. Technological advances have improved energy efficiency, these advances include:

- annular shaft kilns (17),
- use of pulverized coal as a fuel (17),
- use of waste chemicals as fuel (9), and
- improved kiln insulation.

These improvements have reduced costs while maintaining or improving product quality.

Lime has few substitutes and should have secure markets for many years. Gypsum and fly ash compete only for minor markets such as agriculture or soil stabilization. However, competition among lime producers may increase as consumers (especially in the chemical and iron and steel industries) demand increasingly more stringent product specifications.

4.2.10 Phosphate Rock

The essential fact about phosphate rock is that it is an essential mineral in limited supply. There is no substitute for phosphate rock as a source of phosphorus for fertilizer. In turn, phosphorus is a critical nutrient for plant growth. (7) At present the supply of phosphate exceeds the demand; however, by the year 2000 many of the low-cost, high-quality deposits (mainly in Florida) will be exhausted and demand could meet and even exceed supply.

In Canada, supply shortages could start occurring in the 1990s as Florida's mines become exhausted. New sources will have to be secured through the western United States and Morocco. (18)

Although phosphate rock producers have a bright future, the current situation is not ideal. Prices are low and a growing number of mining and waste disposal problems face producers. Radon gas has been associated with phosphate rock mining. (19) Clay and phosphogypsum are waste products which are difficult to dewater. In addition phosphogypsum has low level radiation. (20)

Research and development efforts have focused upon the use of phosphogypsum as a raw material for wallboard and aggregate. (6, 20, 21) If the mining and waste disposal problems can be overcome, the short-term outlook for phosphate rock producers is good.

4.2.11 Potash

There is already a well-established world market for potash so there should be little change in the structure of the market in the future.

In terms of production, Canada will continue to be one of the largest producers and exporters for many years. Other producing countries will join the market (Jordan in 1982) or drop from the market (possibly the United States).

There is no substitute for potash in fertilizer so 90 percent of potash markets are secure. However, the dependence upon agriculture makes the potash market very volatile in terms of price and sales volume.

Developments in potash will include improved mining techniques (perhaps using solution mining), improved processing techniques (which could extend the range of extractable ores) and environmental improvements (reduction in surface subsidence over mines, use of waste material as backfill, reduction in pollution). (22)

4.2.12 Salt

The salt industry is dominated by a few large companies and four major uses: chloralkalies, deicing, food production, and agriculture (77 percent in total). The outlook is good.

Demand for caustic soda and chlorine should grow steadily over the next few years. Pulp bleaching, wastewater treatment, and plastic production should lead the growth. There is no substitute for salt in chloralkali production. (23)

Long-standing concerns regarding the effect of road salt upon the environment have spurred research into alternative deicing materials. To date, no equivalent low-cost alternative has been found. Thus, deicing remains a major salt market but one with little growth (2 percent a year) and some potential for shrinkage.

In the food processing and agriculture (livestock and poultry) sectors low growth appears likely due to concerns regarding sodium and cholesterol. There is no suitable substitute for salt in food processing and agriculture. There are food enhancers but they do not displace salt. (24, 25)

4.2.13 Silica

Silica markets will continue to shrink in the short-term as the major market segments for silica are either stable or shrinking: flat glass, glass containers, automobile glass, sand blast sand, refractories, foundry sands, and silicon and ferrosilicon alloys. This is the major trend in the silica industry.

Some of the silica markets are basically strong and should recover in the long-term (flat glass and silicon alloys), other markets have shrunk but should continue to be strong once new market conditions are established (containers, automobile glass); while other markets are in long-term decline (foundry sand, refractories, sand blast). (26) What this all means is that silica producers are facing a difficult time in the short- to medium-term.

For silica demand to recover to former levels, either new markets will have to be discovered (fibre optics, silica filler) (27) or old markets (containers) revived. This is likely, for silica is a mineral with many useful properties, one of which is its high compatibility with the natural environment.

Other key trends affecting silica:

- better mining and processing techniques which enhance recovery for high grade and low grade deposits. (27)

- thinner, stronger glass.

4.2.14 Sulphur

Sulphur is a very useful mineral with a wide range of uses. It will likely retain its popularity because of its valuable chemical and physical properties as well as its low price and abundance.

In the short term, some sulphur shortage is possible as demand exceeds supply in the Western World. However, alternative existing (Eastern Bloc) and potential (gypsum) sources are available, so in the long-term prices may remain stable.

The key factor which will affect sulphur markets in the future is the capture and reuse of sulphur dioxide gases from the combustion of oils, gas, and organic fuels and the smelting of sulfide minerals ores. This could represent a significant source of sulphur.

At present, most sulphur dioxide is released to the atmosphere but this alternative is no longer acceptable environmentally. With new technologies and higher sulphur prices, atmospheric release may soon be economically unacceptable as well. On the consumption side, sulphur has great potential. Sulphur-asphalt mixes show great potential as road materials. One kilogram of sulphur can be used to replace 1.6 kilograms of asphalt with road properties maintained. (28) Sulphur-concrete, too, shows promise. The growth in fertilizer use means that more sulphuric acid will be required for the production of superphosphates and ammonia. (29) As a micronutrient, sulphur itself is in demand for some crops and soil conditions.

These growth trends should outweigh market losses in the pulp and paper (more efficient use and recycle of sulphur chemicals) and metal processing (a switch to hydrochloric and other acids).

4.3 Projecting Industrial Minerals Markets

In this chapter the future prospects for demand of industrial minerals are addressed. The analysis proceeds at two levels:

1. an economic forecast and industrial performance prospectus of Canada and the U.S.A.; and

2. a consumption growth outlook profile of industrial minerals classes for this study as being of high and moderate importance.

The general economic forecasts and industrial performance profiles present the market setting on which the individual industrial minerals demand growth prospects rest.

Data for this chapter have been acquired from the following sources:

1. Statistics Canada publications;

2. U.S. Department of Commerce publications;

3. Energy, Mines and Resources Canada publications;

4. U.S. Bureau of Mines publications; and

5. New Brunswick industrial mineral, producers and consumers interviews conducted for this study.

Canada/U.S.A. Economic and Industrial Performance

In this section the past North American economic performance and future growth prospects are presented for both Canada and the U.S.A. and their respective regions. In addition, an indication

of the recent industrial performance of key industries which consume and produce industrial minerals is presented for each country. These forecasts and performance profiles set the stage for individual industrial mineral demand growth forecasts.

Tables 1 and 2 present the Gross Domestic Product (GDP) of Canada and Gross National Product of U.S.A., respectively, in constant dollars for the period 1970 to 1987. National economic growth projections are given for each country to year 2010. The Canadian average annual growth rate of GDP is projected at 3.1 percent, while U.S.A. average annual growth rate of GNP is projected at 1.8 percent through the forecast period. Figures 1 and 2 present graphically the historic and projected GDP and GNP of Canada and the U.S.A., respectively.

Table 3 presents the regional GDP for the four Canadian regions - Atlantic Provinces, Quebec, Ontario and Western Provinces - from 1970 to 1986 in constant dollars. The Atlantic Provinces GDP has grown at an average of 3.7 percent per annum over the period, which compares closely with the Canadian average annual growth rate of 3.9 percent during the same period.

Table 4 presents the past and projected future regional GNP growth rate of the four U.S. regions - Northeast, Midwest, South and West - along with the total average annual growth rate of U.S.A. Of most significance is the slightly below average projected growth for the northeast region, despite the recent past above average growth rate of the New England states. However, the major prospective bulk freight trading states accessible to New Brunswick - New England, Mid-Atlantic, South Atlantic, East South Central and West South Central - all have been projected to have about or above average growth.

Table 1

CANADIAN GROSS DOMESTIC PRODUCT *
($ 1981)

Historic GDP		Projected GDP	
Year	($ Million)	Year	($ Million)
1970	$219,498	1988	$437,708
1971	232,137	1989	443,399
1972	245,441	1990	455,814
1973	264,369	1991	473,590
1974	276,006	1992	488,272
1975	283,187	1993	503,408
1976	300,638	1994	519,014
1977	311,504	1995	535,103
1978	325,362	1996	551,691
1979	338,751	1997	568,794
1980	343,384	1998	586,427
1981	355,994	1999	604,606
1982	344,543	2000	623,349
1983	355,445	2001	642,672
1984	377,865	2002	662,595
1985	395,217	2003	683,136
1986	407,736	2004	704,313
1987	424,136	2005	726,147
		2006	748,657
		2007	771,865
		2008	795,793
		2009	820,463
		2010	845,897

* Expenditure Based

Source: Statistics Canada

Table 2

USA GROSS NATIONAL PRODUCT ($ 1982)

Historic GNP		Projected GNP	
Year	($ Billion)	Year	($ Billion)
1970	$ 2,467.7	1988	$ 3,889.9
1971	2,568.5	1989	3,959.9
1972	2,736.2	1990	4,031.1
1973	2,744.0	1991	4,103.7
1974	2,729.3	1992	4,177.6
1975	2,695.0	1993	4,252.8
1976	2,826.7	1994	4,329.4
1977	2,958.7	1995	4,407.3
1978	3,115.2	1996	4,486.6
1979	3,192.3	1997	4,567.4
1980	3,187.2	1998	4,649.6
1981	3,248.7	1999	4,733.3
1982	3,166.0	2000	4,818.5
1983	3,279.1	2001	4,905.2
1984	3,501.4	2002	4,993.5
1985	3,607.4	2003	5,083.4
1986	3,713.3	2004	5,174.9
1987	3,821.1	2005	5,268.0
		2006	5,362.9
		2007	5,459.4
		2008	5,557.7
		2009	5,657.7
		2010	5,759.5

Source: U.S. Department of Commerce

FIGURE 1

CANADIAN GROSS DOMESTIC PRODUCT
($ 1981)
HISTORIC
PROJECTED
GDP ($ MILLION)
900
800
700
600
500
400
300
200
1970
1975
1980
1985
1990
1995
2000
2005
2010
YEAR

FIGURE 2

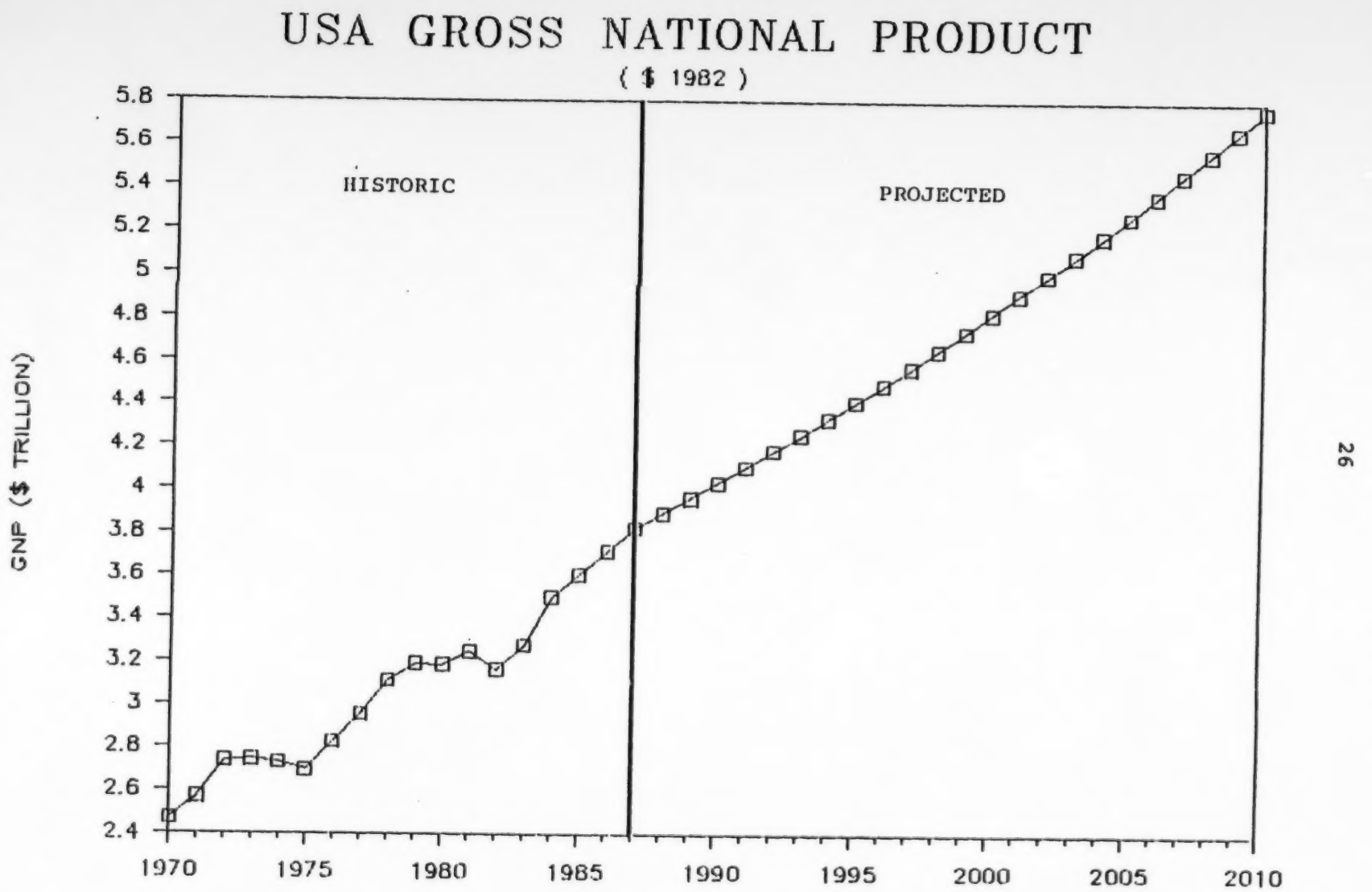
USA GROSS NATIONAL PRODUCT
($ 1982)
HISTORIC
PROJECTED
GNP ($ TRILLION)
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
1970
1975
1980
1985
1990
1995
2000
2005
2010
YEAR

Table 3

GROSS DOMESTIC PRODUCT OF CANADIAN REGIONS* ($ 1981)
($ MILLION)

Year	Atlantic Provs.	Quebec	Ontario	Western Provs.
70	$ 13,002	$ 54,839	$ 90,563	$ 56,451
71	13,678	57,514	96,149	60,481
72	14,636	61,577	103,434	64,821
73	15,809	64,975	110,790	74,851
74	16,475	68,830	116,665	85,938
75	16,573	69,990	116,520	88,728
76	18,110	75,830	124,305	95,439
77	18,376	76,894	124,686	97,944
78	18,854	78,650	125,053	103,068
79	20,038	80,470	129,322	111,062
80	18,281	81,237	129,352	118,082
81	18,950	81,513	131,831	122,124
82	19,042	77,823	123,926	115,329
83	20,283	78,732	129,646	117,858
84	21,581	82,553	139,519	117,680
85	22,164	85,752	145,419	120,394
86	23,161	90,211	154,389	114,091
Average Annual Growth Rate (1970 - 86)	+ 3.7 %	+ 3.2 %	+ 3.4 %	+ 4.5 %

*GDP is Income Based

Source: Statistics Canada

Table 4

U.S. REGIONAL INCOME GROWTH (%)*

Area**	1973 - 1983	1983 - 2000
Northeast	1.6	1.7
New England	2.0	1.7
Mid Atlantic	1.4	1.6
Midwest	0.8	1.9
East North Central	0.8	1.9
West South Central	0.8	1.9
South	1.9	1.9
South Atlantic	1.6	2.1
East South Central	1.6	2.1
West South Central	2.5	1.9
West	1.6	1.6
Mountain	1.4	1.9
Pacific	1.7	1.6
USA	1.4	1.8

* Real Growth in constant dollars

** New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut
Mid Atlantic: New York, Pennsylvania, New Jersey
East North Central: Ohio, Michigan, Indiana, Illinois, Wisconsin
West North Central: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas
South Atlantic: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida
East South Central: Kentucky, Tennessee, Alabama, Mississippi
West South Central: Arkansas, Louisiana, Oklahoma, Texas
Mountain: Montana, Idaho, Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada
Pacific: Washington, Oregon, California, Alaska, Hawaii

Table 5 presents the Canadian GDP in constant dollars of five key mineral consuming industrial sectors - agriculture, fishery/ forestry, mining, manufacturing and construction - for the years 1975 to 1987. The mining sector has only a 0.9 percent average annual growth rate for the period, due mainly to the slump of the early 80's. The agricultural sector has grown at 1.6 percent per annum, and is the major consumer of aglime, as well as potash and phosphate rocks used in fertilizers. The fishery/ forestry sector has experienced 4.0 percent annum growth and is a major consumer of sulphur and sulfuric acid for pulp, and salt for chlorine and caustic soda also used in pulp. The manufacturing sector has grown at 3.1 percent per annum and is a major consumer of diatomite for industrial filters as used in breweries and kaolin for coated paper. The construction sector grew at 3.0 percent per annum and represents the derived demand for numerous industrial minerals including clay and brick shale for bricks, gypsum for wallboard, graphite for steel, silica for glass, and cement for concrete products.

Table 6 presents the actual percentage capital utilization rates* of Canadian manufacturing industries from 1977 to 1986, which are indicative of the derived demand for industrial minerals. Most of these industries dropped off through the early 1980's, but have returned or are returning to previous production levels of the 70's.

Table 7 presents the Gross National Product by industry in the U.S.A. from 1980 to 1985 in constant dollars. Of note is the decline in the mining industry and low growth in construction during this period. Agriculture and forestry industries including pulp and paper have achieved considerable growth in the recent period.

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*An indication of industrial activity, capital utilization rates are the percentage of industrial infrastructure in use at any one time. The values are different for each industry and reflect the effects of annual maintenance shutdowns, strikes, economic slowdowns, overtime, etc.

Table 5

CANADIAN GROSS DOMESTIC PRODUCT BY INDUSTRY ($ 1981)*
($ Million)

Year	Agriculture	Fishery/Forestry	Mining	Manufacturing	Construction
75	$ 9,706	$2,199	$19,575	$51,641	$18,863
76	10,560	2,398	19,643	55,429	21,250
77	10,446	2,614	18,956	57,440	22,341
78	9,999	2,872	17,940	60,057	21,222
79	9,191	2,805	20,272	62,309	21,440
80	9,736	2,854	19,720	59,518	22,527
81	10,611	2,873	17,511	61,709	25,094
82	11,277	2,567	17,028	53,755	25,109
83	10,951	3,090	18,123	57,230	24,667
84	10,677	3,231	20,753	65,979	23,461
85	11,104	3,275	21,603	69,593	24,734
86	12,228	3,358	21,114	71,180	25,369
87	11,774	3,527	21,883	74,575	27,050
Average Annual Growth Rate: (1975 - 87)					
	+ 1.6 %	+ 4.0 %	+ 0.9 %	+ 3.1 %	+ 3.0 %

* at factor costs

Source: Statistics Canada

Table 6

AVERAGE CAPITAL UTILIZATION RATES OF CANADIAN MANUFACTURING INDUSTRIES

Industry	77	78	79	80	81	82	83	84	85	86
Food Industries	90.5	89.0	88.8	86.5	85.5	82.4	80.2	79.1	79.9	79.5
Beverage Industries	88.0	85.7	87.0	83.5	82.1	75.9	75.6	73.9	73.8	74.6
Paper & Products	80.9	88.2	88.0	87.8	83.5	71.8	78.5	80.9	82.9	85.7
Printing/Publishing	84.7	87.8	89.9	95.0	93.6	87.3	92.2	95.0	94.9	98.7
Primary Metals	80.0	83.0	84.3	82.0	77.8	58.1	65.8	75.7	75.3	73.6
Mineral Products	80.2	82.5	84.3	74.4	71.5	59.7	62.7	69.0	75.0	80.7
Chemicals & Products	74.1	71.2	73.5	70.0	66.9	56.1	57.6	60.2	62.3	61.0

Source: Statistics Canada

Table 7

GROSS NATIONAL PRODUCT BY INDUSTRY IN USA ($ 1982)
($ MILLIONS)

Industry	Year					Average Annual Growth Rate (1980 - 1985)
	80	82	83	85	85	
Agriculture, Forestry, Fishery	76.2	89.6	74.5	84.0	92.2	+ 3.9 %
Farms	64.2	77.0	61.3	69.6	77.6	+ 3.9 %
Mining	135.6	132.1	125.4	133.0	130.6	- 0.7 %
Construction	161.6	140.9	147.3	159.9	163.1	+ 0.2 %
Manufacturing:						
- Stone, Clay, glass products	21.1	18.2	19.7	22.0	22.2	+ 1.0 %
- Paper & paper products	24.6	26.7	28.7	30.0	31.2	+ 4.9 %
- Printing & publishing	36.9	38.4	39.9	40.9	41.6	+ 2.4 %
Chemicals & products	50.1	55.3	59.6	63.4	62.6	+ 4.6 %

Source: U.S. Department of Commerce

4.3.1 Industrial Minerals Consumption Growth Outlook

The previous section indicated that the general North American economy and industrial mineral marketplace are projected to remain at stable, but relatively low growth levels. In general, higher growth in demand for New Brunswick produced industrial minerals may be realized through free trade with the United States, expansion of overseas markets, offshore petroleum development, or other industry specific market opportunities. Otherwise continued low growth in demand of most industrial minerals produced in New Brunswick might be expected in the short and long term future.

In this section the specific market outlook will be discussed for each industrial mineral of the high and moderate importance classes designated for this study. This discussion examines the growth in demand prospects for the minerals as required for industrial uses. It does not, however, identify the new market penetration prospects for New Brunswick producers in competition with producers elsewhere.

4.3.2 High Importance Class Industrial Minerals

Table 8 presents the six high priority importance industrial minerals identified for this study along with their respective primary products. Each will be discussed with respect to their industrial consumption growth prospects.

Clay and Brick Shale. According to local industrial officials the local market for clay and brick shale has been growing slowly but steadily. Additional markets for brick exists in central Canada and the northeastern United States, but high energy and transportation costs has limited market expansion. High potential demand increases for expanded brick shale (lightweight aggregates) from the Minto-Chipman area hinge on the prospective "fixed link to PEI" use of the material in concrete materials.

Table 8

HIGH PRIORITY IMPORTANCE INDUSTRIAL MINERALS

Minerals	Primary Products
1. Clay/Brick/Shale	Bricks
2. Limestone/Lime	Aglime Quicklime Hydrated Lime Aggregates
3. Dolomite	Aglime Aggregates Fillers/Flux
4. Gypsum	Wallboard Cement Fillers
5. Potash	Fertilizers
6. Salt	Road Salt Caustic Soda Chlorine

In Canada the general outlook for structural clay is expected to remain stable, but with the normal market fluctuations typified by the residential and non-residential construction industries sensitive to interest rate, inflationary and other economic changes. The demand for refractory clay is expected to decline slightly due to the decreasing demand for steel.

In the United States consumption of structural clays and shale account for 70 percent of all clays. In recent years the heavy clays consumption has grown with the residential construction, but lightweight shales have declined due to the decline in non-residential construction activity.

The United States Bureau of Mines projects American demand for clays to grow an average of 3.1 percent per annum until year 2000. The same growth rate is projected for the world demand for clays.

Limestone/Lime. Agricultural lime (aglime) is the primary product of local lime producers in New Brunswick. Secondary uses are for industrial fillers and processing lime (quicklime and hydrated lime). Growth in demand for lime from New Brunswick will largely depend on the agricultural sector.

The demand for cement, refractory (steel), industrial (pulp and paper) and mining industries is limited in the region.

The local demand for aglime may be enhanced in the future as a result of soil degradation from acid rain.

Lime (quicklime and hydrated) is relatively cheap, bulky and abundant throughout North America; therefore market penetration is unlikely. Otherwise the lime industry should remain stable and in line with the agricultural sector growth.

The United States Bureau of Mines projects lime consumption in the United States to increase by an average of 3.7 percent per annum until year 2000, whereas world consumption growth will average 3.1 percent per annum during the period.

Dolomite. The major use of dolomitic limestone is for construction aggregates (asphaltic and cement concrete). Aglime and fertilizer fillers also constitute a large market for dolomite. The markets are primarily the local Maritime region, including northern Maine. As with calcinated limestone, further market penetration is unlikely. The outlook for dolomitic lime is that it will likely remain stable with growth in demand conditional upon the performance of the local agricultural and construction industries.

Gypsum. Gypsum production in New Brunswick has all but ceased since the closure of the cement plant in Havelock and the wallboard plant in Hillsborough. Wallboard and cement are the primary consuming products of gypsum. Wallboard and cement plants are typically located at or near gypsum sources, as raw gypsum is a bulky, low valued and relatively expensive substance to transport. However, Nova Scotia gypsum mines supply raw gypsum to American wallboard producers by means of large scale trains to ocean vessels for export.

The future outlook for raw gypsum demand in New Brunswick rests on the reinstatement of the cement or wallboard plants. Both prospects are being investigated. Exploitation of gypsum resources for production elsewhere seems unlikely, at least in the near future.

The United States Bureau of Mines projects United States demand for gypsum to grow at an average rate of 2.6 percent per annum until year 2000. World demand is similarly projected to increase at an annual average rate of 2.5 percent during the period.

Potash. Most New Brunswick potash is produced and exported for use in fertilizers. Its future growth prospects are thereby linked to the international agricultural industry and global market conditions. A relatively small proportion of potash produced is consumed locally. Price competition is stiff in the industry, although United States prices have stabilized subsequent to recent rulings on tariffs.

The recent years have seen decreased demand and depressed prices. It is expected that world demand will return to about two percent per annum growth levels at about 1990, and continue thereafter. Increased utilization of the New Brunswick potash mines should occur at that time.

The United States Bureau of Mines projects American average annual growth in consumption of potash at 1.8 percent to year 2000. World consumption of potash is projected at 2.9 percent per annum to year 2000.

Salt. Salt is mined in New Brunswick as a by-product of potash. The primary markets for this salt are for road de-icing and for chemicals, particularly chlorine and caustic soda. These chemicals are used primarily for New Brunswick pulp and paper industries. Road salt is used for local distribution and is also supplied to the eastern United States.

The chemical uses of New Brunswick salt are expected to grow at about three percent to 1995. Road salt demand is expected to grow at a slow but steady rate of between one or two percent in Canada.

The United States Bureau of Mines projects United States consumption of salt for chlorine and alkalies to grow an average of 2.3 percent per annum to year 2000. Road salt is expected to grow at about 3.3 percent per annum during this period.

4.3.3 Other High and Moderate Importance Class Industrial Minerals

Table 9 presents a summary of the projected demand for eight industrial minerals consumed and/or produced in New Brunswick classed as having high or moderate importance in this study. The table indicates whether the minerals are produced or consumed in New Brunswick, the major use or consumer industry (ies), and the future market demand growth outlook.

4.4 Transportation of Industrial Minerals

The choice of transport mode used in the carriage of industrial minerals is largely a function of the volume of freight, demand and distance of haul. However, other factors may dictate mode choices which are less apparent. These may include:

i) lack of convenient access to a transport mode infrastructure, such as ports or rail sidings and terminals;

ii) costly intermodal delivery to and from terminals by truck;

iii) delivery timing requirements of consuming industry(ies);

iv) inability to secure or position a particular transport mode as required;

Table 9

HIGH AND MODERATE PRIORITY IMPORTANCE INDUSTRIAL MINERALS

	Mineral	New Brunswick Consumer/Producer	Major Use/ Consumer(s)	Regional Demand Growth Outlook
1.	Silica	Both	glass, flux	NB - Growing, but well below capacity production Canada - Stable to declining U.S. - Projected at 2.2% per annum to year 2000 World - projected at 1.7% per annum to year 2000
2.	Sulphur/ Sulphuric Acid	Both	pulp, fertilizer	NB - Presently growing Canada - high growth U.S. - Projected at 3.2% per annum to year 2000 World - projected at 3.4% per annum to year 2000
3.	Diatomite	Consumer	filter medium	NB - stable Canada - 4% per annum to 1990
4.	Dimension Stone	Both	monuments, ornamental stone	NB - stable Canada - periodic surges of demand; otherwise stable U.S. - stable World - stable
5.	Graphite	Neither	steel	Canada - stable to declining U.S. - low growth World - projected at 1.5% per annum to year 2000
6.	Kaolin	Consumer	coated paper	NB - high growth Canada - high growth U.S. - projected 3.2% per annum to year 2000
7.	Phosphate Rock	Consumer	fertilizer	NB - stable to declining Canada - Stable to declining U.S. - projected 1.85% per annum to year 2000 World - projected 3.6% per annum to year 2000
8.	Cement	Consumer	concrete products	NB - stable Canada - stable to low growth

v) incompatibility of available equipment with freight in-transit storage and handling requirements; and

vi) availability of a backhaul movement to a particular transport mode for round trip economics.

The choice of equipment within a transport mode is dictated by the nature and packaging of freight being hauled. Palleted, crated or other packaged freight may be containerized or shipped in box cars, flatbeds or vans. Bulk materials, which include most industrial minerals, are hauled in vehicles which provide containment specific to the form of the industrial mineral substance. These include the various modal equipment configurations of:

i) open and closed bulk vessels; or

ii) liquid and dry tankers.

Table 10 presents a summary of equipment options available for each transport mode.

i) single-unit trucks;

ii) tractor semi-trailer trucks;

iii) rail cars; and

iv) ocean vessels.

Typically single unit trucks are used for very short hauls (under 50 km) movements, or on-site or near site functions, from the mines to the processing plants. Tractor semi-trailers, rail

Table 10

TRANSPORT MODE SYMBOLS

SUTV	single unit truck van; 2 or 3 axle
SUTD	single unit dump truck; 2 or 3 axle
SUTF	single unit flatbed truck; 2 or 3 axle
TSTV	tractor-semi trailer transport van; 5 or 6 axle
TSTD	tractor-semi trailer dump truck; 5 or 6 axle
TSTF	tractor-semi trailer flatbed transport; 5 or 6 axle
TSTP	tractor-semi trailer pneumatic tanker; 5 or 6 axle
TSTL	tractor-semi trailer liquid tanker; 5 or 6 axle
RCO	open-top hopper rail car
RCC	covered hopper rail car
RCP	pneumatic tanker rail car
RCL	liquid tanker rail car
RCB	rail boxcar
OVB	bulk carrier ocean vessel
OVC	conveyor self unloading ocean vessel
OVP	pneumatic self unloading ocean vessel
OVL	liquid bulk tanker ocean vessel
OVF	freight carrier ocean vessel

cars and ocean vessels are used for longer hauls and/or for large volume hauls. Trains are usually most effective for hauls of more than four or five hundred kilometres, but may be used for much shorter and dedicated "unit train" hauls, such as potash from Sussex to Saint John. Ocean vessels are mainly used for long continental and overseas movements of minerals. Tug hauled barges have been used for some short movements of minerals elsewhere, but not in New Brunswick. Tractor semi-trailers may be used in medium and long haul movements or large volume short-haul movements. Tractor-semitrailer transports provide quick, direct and small volume capabilities, with which rail and marine transport modes have difficulty competing.

Table 11 presents a summary of all industrial minerals for the "high" and "moderate" importance classes distinguished for this study. The transportation mode(s) used are given for each mineral to its processing plant. Similarly, the transport mode(s) used for hauling the processed mineral to the product and consuming industry markets are given by market areas:

i) local (within New Brunswick);

ii) U.S./other Canadian (primarily other Atlantic Provinces, Quebec, Ontario, and New England, Mid-Atlantic and South Atlantic States); and

iii) overseas (off the North American continent).

An asterisk indicates that the mode is not presently under use, but would be an appropriate choice for the movement. It also indicates the potential mode(s) of a prospective indigenous New Brunswick industrial mineral presently not being exploited.

Table 11

TRANSPORT MODE USE MATRIX

Industrial Mineral	Primary Product(s)	Transport Mode(s) Used To: Processing Plant	Product Market Areas: Local	US/Oth. Can	Overseas
HIGH IMPORTANCE CLASS:					
Limestone/Lime/ Dolomitic Lime	Aglime	SUTD	SUTD TSTV TSTD TSTP	TSTD TSTP TSTV RCC	TSTP/OVP* TSTD/OVB*
	Quicklime	SUTD	TSTD	TSTD* RCC*	TSTD/OVB* TSTD/OVC*
	Hydrated Lime	SUTD	TSTL	TSTL* RCL*	TSTL/OCL*
	Aggregates	SUTD	SUTD TSTD	TSTD* RCO* TSTD/OVC*	TSTD/OVC*
	Flux/Fillers	SUTD	TSTD	TSTD TSTD/OVC	TSTD/OVC*
Gypsum	Wall Board	SUTD* TSTD*	TSTF*	TSTF* RCB*	TSTD/OVF*
	Cement	SUTD* TSTD*	TSTV* TSTP*	TSTP* TSTP/OVP*	TSTP/OVP*
	Filler	SUTD* TSTD*	TSTD*	TSTD* RCC*	TSTD/OVC*
Clay/ Brick Shale	Brick	SUTD* TSTD*	TSTF	TSTF	TSTF/OVF*
Potash	Fertilizer	SUTD	TSTD	RCC/OVC	RCC/OVC
Salt	Road Salt	SUTD	TSTD SUTD	TSTD/OVC TSTD/OVB	TSTD/OVC TSTD/OVB
	Chlorine	SUTD	TSTD	N.A.	N.A.
	Caustic Soda	SUTD	TSTD	N.A.	N.A.

Table 11
(Cont'd)

TRANSPORT MODE USE MATRIX

Industrial Mineral	Primary Product(s)	Transport Mode(s) Used To: Processing Plant	Product Market Areas: Local	US/Oth. Can	Overseas
MODERATE IMPORTANCE CLASS:					
Diatomite	Filter Medium	N.A.	RCB	N.A.	N.A.
Silica	Glass	SUTD	RCC TSTD	RCC* TSTD*	N.A.
	Blasting Sand	SUTD	TSTD TSTV	TSTD TSTV	N.A.
	Flux	SUTD	TSTD RCC	TSTD RCC	N.A.
	Silicon carbide	SUTD	N.A.	RCC	N.A.
Kaolin	Coated paper	N.A.	OVL/TSTL	N.A.	N.A.
Sulphur/ Sulphuric Acid	Pulp	N.A.	RCL TSTL	RCL TSTL	N.A.
	Fertilizer (diammonium phosphate)	N.A.	TSTL	N.A.	N.A.
Dimension Stone	Monuments	N.A.	TSTF	TSTF	N.A.
	Ornamental Stone	N.A.	TSTF	TSTF	N.A.
Graphite (Natural)	Steel	SUTD*	N.A.	TSTD*	N.A.

*An appropriate mode not currently in use.

Movements indicated with an "N.A." either do not exist or are inapplicable to New Brunswick. For instance, kaolin is not mined in New Brunswick, but is imported from Georgia for filter sand, bagged rail boxcars. How it is delivered to the processing plant in Georgia is not of interest to this study. Movements which involve intermodal activity are indicated by a slash between the interacting modes. For instance, RCC/OVC indicates the intermodal movements of rail to ocean vessel.

Table 11 is not exhaustive as to the primary consuming product industry or all modal choices. However, the major and most common opportunities are indicated.

4.5 Conclusions

4.5.1 General

Markets for industrial minerals are experiencing significant and long-term changes. The changes are caused by four major trends: substitution, the rise of applications design, the creation of a global economy, and market saturation.

Some mineral markets will grow because of the changes, other markets will fall, but the important point is, that all will change. Mineral producers, processors, consumers, researchers, and government officials will all need to prepare for the changes, otherwise they could miss opportunities or be caught in a market slump.

Not only are the changes profound, they are also rapid. Preparation is not enough, flexibility and quick response are also required to meet the changes.

The best strategy for handling change is to keep close contact with customers, for most of these changes are originating with the customers.

In response to change, there has been an increase in corporate concentration in the mineral industry. To deal with the concentration, New Brunswick producers and suppliers will either have to join one of the large firms in a business relationship or seek a special market niche which is either too small or too specialized for the large firms to supply.

Third world producers, recycled materials, and by-products all represent inexpensive and plentiful sources of raw material for mineral consumers. To compete with these sources, New Brunswick producers and suppliers will need to stress non-price benefits such as product purity, quick delivery, and customer service to justify higher selling prices.

New Brunswick producers and processors should continually strive to reduce production and processing costs by increasing labour productivity and reducing the cost and quantity of inputs (raw materials, energy). Outmoded or inefficient operations will not compete well.

Another path to longevity and profitability for New Brunswick firms is increasing the value-added of their products. The value-added principle requires firms to study and then meet customer demands: high purity, specific material size, mineral processing (calcining, coating), packaging (conveniently sized units rather than bulk), transportation (just-in-time deliveries, moisture controlled vehicles).

In some cases, meeting value-added requirements will require firms to support research and development projects either within New Brunswick or elsewhere. Several associations of mineral

producers and processors sponsor research and development work; New Brunswick firms would be well-advised to join and support these associations.

Environmental and public health concerns have become permanent in today's business environment and should continue to remain paramount in the future. Again, the key is to keep abreast of developments and respond quickly to opportunities or crises. New Brunswick producers should operate their premises acceptably and respond to environmental complaints quickly and reasonably.

4.5.2 Mineral Specific

Cement. Cement should continue to be used widely and to benefit from substitution for steel, wood and other structural materials. The keys to future prosperity in the cement industry are efficient, low-cost production and consumer-responsive marketing.

Clay. There will likely be a major reorganiztaion of the clay products industry in the next few years, resulting in fewer, larger firms. The keys to profitability will be improved mining and processing, and better energy efficiency. Demand should grow at 3.1 percent per year until the year 2000.

Diatomite. This mineral has good prospects.

Dimension Stone. Dimension stone markets will continue to be healthy.

Dolomite. New Brunswick demand for dolomite will continue to be dependent upon the aggregate and aglime markets.

Graphite. This mineral has good prospects.

Gypsum. Gypsum markets are dependent upon the health of the construction industry. Within the construction industry, gypsum is in a strong position. A trend of concern for a New Brunswick producer is the potential low-cost supply sources of phospho-gypsum and flue-gas gypsum. Demand should grow at 2.6 percent per year until the year 2000.

Kaolin. This mineral has good prospects.

Lime and Limestone. The use of lime and limestone will grow with the environmental protection effort. Both products are very effective for neutralizing acid water and soil and flue-gas desulphurization. Demand should grow at 3.7 percent until the year 2000.

Phosphate Rock. In the short-term, phosphate rock markets are soft with supply exceeding demand. In the long-term (past the year 2000), prospects are excellent as phosphate rock is a very important mineral with only limited known reserves. New Brunswick's phosphate fertilizer producer may face tight raw materials supply in the future.

Potash. After years of low prices, potash markets are improving. The market outlook remains volatile because potash is dependent upon agriculture for 90 percent of consumption. Unlike phosphate rock, there are ample resources of potash. Demand is expected to grow at 2.0 percent per year until the year 2000.

Salt. The market outlook for salt is good in all four of its major markets: chloralkali, de-icing, food production, and agriculture. Demand for chloralkalies is expected at 2.3 percent per year to the year 2000, road salt, 3.3 percent per year.

Silica. In the short-term, silica markets are flat with some components in decline (containers, sand blasting, foundry, and refractories) and others strong (flat glass, silicon alloys). In the long-term, silica markets should recover as silica has many uses and, in most cases, is environmentally benign.

Sulphur and Sulphuric Acid. Sulphur demand should remain strong as sulphur is an abundant, inexpensive and very useful mineral. Prices may be volatile because of the potential for large volumes of recovered sulphur and sulphuric acid entering the market from pollution control projects such as those at the Belledune smelter and the Irving Oil refinery.

4.5.3 Transportation

Transportation costs can represent a significant proportion of delivered mineral cost. In some cases, transportation costs can be the determining factor for business feasibility.

To minimize transportation costs, producers and shippers should consider the following points:

1. Ships are by far the lowest cost tranpsortation mode, followed by train and truck.

2. Each transshipment of material between modes (truck to train, train to ship) increases costs significantly.

3. The smaller the vehicle, the better the control over the delivered product and over the speed of delivery.

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